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(54) MAGNETIC RECORDING MEDIUM AND ITS PRODUCTION

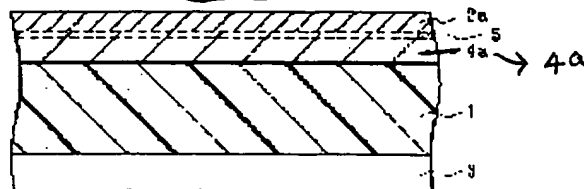
(57)Abstract:

PROBLEM TO BE SOLVED: To provide a magnetic recording medium having high electromagnetic conversion characteristics adequate for high-density recording and a process for producing the same.

SOLUTION: A nonmagnetic base 1 is provided thereon with a lower layer 4a consisting of a nonmagnetic layer formed by dispersing nonmagnetic powder into a binder and an upper layer 2a consisting of a magnetic layer formed by dispersing magnetic powder into the binder. A dispersant consisting of polytitanium (or polyzirconium) acetyl acetonate is incorporated into the lower layer 4a.

At the time of producing such magnetic recording medium, a nonmagnetic coating material for forming the lower layer 4a and a magnetic coating material for forming the upper layer 2a are simultaneously applied wet on wet on the nonmagnetic base 1.

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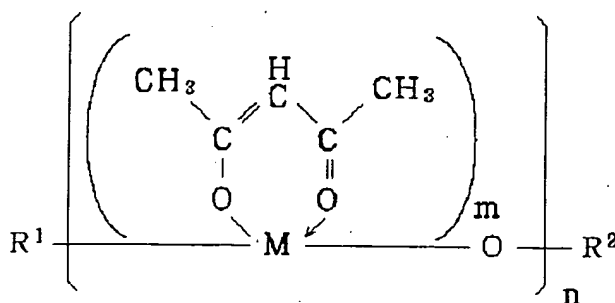
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 CLAIMS

[Claim(s)]

[Claim 1] The magnetic-recording medium which the dispersant with which the lower layer which nonmagnetic powder becomes from the non-magnetic layer distributed in the binder, and the upper layer which magnetic powder becomes from the magnetic layer distributed in the binder are prepared on a nonmagnetic base material, and consists of poly titanium (or poly zirconium) acetylacetonate contains in the aforementioned lower layer.

[Claim 2] The aforementioned poly titanium (or poly zirconium) acetylacetonate [Formula 1]
一般式 (I) :

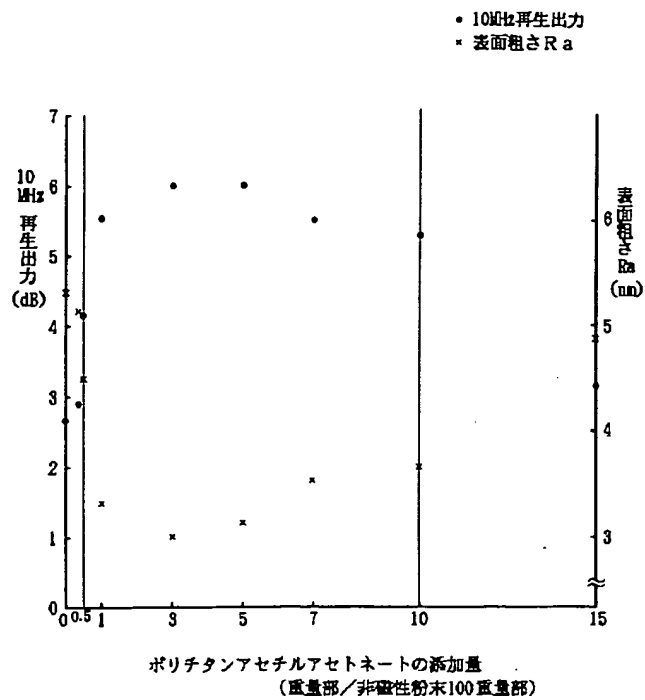


(However, M is a titanium atom or a zirconium atom among the above-mentioned general formula. (R1 and R2) Are the same. or it differs, respectively, a hydrogen atom, a hydrocarbon group, an alkoxy group, A halogen atom, a hydroxyl group, a nitro group, a carboxyl group, a carbonyl group, it is the amino group, an amide group, a sulfonic group and the hydrocarbon group replaced by these either, an aryl group, and the basis chosen from the group which consists of a complex aromatic machine, or the acetylacetonate is coordinating at the end, n shows polymerization degree, m shows the number of ligands, and it is $m \leq 2$ The magnetic-recording medium with which it is expressed and which was indicated to the claim 1.

[Claim 3] The magnetic-recording medium whose aforementioned polymerization degree n is one or more in the poly titanium (or poly zirconium) acetylacetonate expressed with the aforementioned general formula (I) and which was indicated to the claim 2.

[Claim 4] The magnetic-recording medium by which kind content of the poly titanium (or poly zirconium) acetylacetonate expressed with the aforementioned general formula (I) to the aforementioned lower layer is carried out at least and which was indicated to the claim 1.

Drawing selection [Representative drawing]



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the magnetic-recording medium by which the lower layer which nonmagnetic powder becomes from the non-magnetic layer distributed in the binder, and the upper layer which magnetic powder becomes from the magnetic layer distributed in the binder are prepared on the nonmagnetic base material, and its manufacture method.

[0002]

[Description of the Prior Art] In recent years, a magnetic-recording medium is widely used as the tape for audios, videotape, the data cartridge for backup, a floppy disk, etc., and the need is being extended remarkably.

[0003] especially, recently, examination of the high-density record by short-wavelength-izing of record wavelength or the digital storage method carries out briskly -- having -- **** -- electromagnetism -- development of the magnetic-recording medium which was excellent in the transfer characteristic is demanded

[0004] The so-called application type magnetic-recording medium created by applying the magnetic paint which made powder magnetic materials, such as oxide magnetism powder or alloy magnetism powder, distribute in organic binders (binder), such as a vinyl chloride-vinyl acetate system copolymer, polyester resin, a urethane resin, and a polyurethane resin, on a nonmagnetic base material, and drying as such a magnetic-recording medium is used widely.

[0005] such an applied type magnetic-recording medium -- setting -- electromagnetism -- in order to raise the transfer characteristic, thin film-ization of a magnetic layer is considered

[0006] this reduces the self-demagnetization loss at the time of record by thin film-ization of a magnetic layer -- making -- electromagnetism -- the transfer characteristic is raised and various application methods are examined in recent years

[0007] When a thin magnetic layer with a thickness of 0.5 micrometers or less is prepared by the monolayer on a nonmagnetic base material, the influence of the shape of surface type of a nonmagnetic base material tends to appear, and since it is difficult to obtain a smooth front face, while preparing a nonmagnetic under coat between a magnetic layer and a nonmagnetic base material and thin-film-izing a magnetic layer, specifically, the structure of realizing smooth nature of the front face is devised.

[0008] the magnetic-recording medium which, on the other hand, has two-layer [like the above] on a nonmagnetic base material -- setting -- electromagnetism -- for the purposes, such as improvement in the transfer characteristic, and reduction of a noise, there is neither an application defect nor coating sources, and it is required that each class should be formed in a uniform paint film As a way this is realizable, the so-called simultaneous multistory application method which applies simultaneously a magnetic layer (upper layer) and a non-magnetic layer (lower layer) on a nonmagnetic base material by the die coating machine (the die of the knockout method of an extrusion die is used) is proposed.

[0009] Moreover, this application method is effective also as a method of raising the adhesive property of the interface of a vertical layer, and is turning into a central application method of a multistory

application type magnetic-recording medium in recent years.

[0010] Furthermore, generally, in order to make the spacing loss at the time of record reproduction into the minimum, smoothing on the front face of a magnetic layer is attained. In high-density record, since the record wavelength to be used is short, it is easy to be influenced of surface granularity, and especially control of this surface roughness is important.

[0011] electromagnetism with a good magnetic-recording medium -- although it cannot be overemphasized that the ferromagnetic powder in a magnetic layer must be uniformly distributed in a binder, and orientation must be carried out to the longitudinal direction in order to demonstrate the transfer characteristic, the upper thin-film-izing which consists of a magnetic layer, and smoothing become indispensable in many cases

[0012] Therefore, in order to attain the purposes, such as these thin-film-izing and smoothing, as mentioned above, lower layer smoothing which consists of a non-magnetic layer which does the influence greatly is needed.

[0013] Although what is necessary is to turn minutely into more than specific surface area of $50\text{m}^2/\text{g}$, and just to distribute especially the nonmagnetic powder to be used uniformly in a binder, in order to make smooth the lower layer which consists of a non-magnetic layer, there is an inclination for distribution of the powder to the inside of a binder to become difficult, with powdered detailed-izing.

[0014] Although it is possible to lengthen the duration of kneading performed as the technique of solving such a technical problem in case the nonmagnetic paint in a lower layer is prepared, or distribution, problems, such as an injury on nonmagnetic powder and decline in manufacture efficiency, generate and are not desirable.

[0015] on the other hand -- a binder -- inside - SO -- three -- M - OSO -- three -- M - COOM - P=O -- (-- OM --) -- two - NR -- one -- R -- two - NR -- one -- R -- two -- R -- three -- + -- X - > -- NR -- one -- R - - two -- + -- X - etc. -- by making a functional group contain The interaction of a binder and nonmagnetic powder is strengthened and the attempt which raises the dispersibility of nonmagnetic powder is also made.

[0016] However, although the binder which has these functional groups demonstrates the performance which was excellent compared with the conventional binder, the present condition is that it is still difficult to fully distribute the detailed nonmagnetic powder developed as an object for high-density record.

[0017]

[Problem(s) to be Solved by the Invention] this invention is made in view of such the conventional actual condition -- having -- the high electromagnetism for high-density record with the suitable purpose -- it is in offering the magnetic-recording medium which has the transfer characteristic, and its manufacture method

[0018]

[Means for Solving the Problem] That is, the lower layer which nonmagnetic powder becomes from the non-magnetic layer distributed in the binder, and the upper layer which magnetic powder becomes from the magnetic layer distributed in the binder are prepared on a nonmagnetic base material, and this invention requires the dispersant which consists of poly titanium (or poly zirconium) acetylacetonate for the magnetic-recording medium (the magnetic-recording medium of this invention is called hereafter.) contained in the aforementioned lower layer.

[0019] Since the dispersant which becomes the aforementioned lower layer which nonmagnetic powder becomes from the non-magnetic layer distributed in the binder from poly titanium (or poly zirconium) acetylacetonate contains according to the magnetic-recording medium of this invention Even if it can distribute uniformly the nonmagnetic powder in the aforementioned lower layer (namely, non-magnetic layer) in a binder and a solvent and especially the average thickness (after calender processing) of the aforementioned upper layer (namely, magnetic layer) is as thin as 0.5 micrometers or less the front face - - smoothing -- the suitable high electromagnetism for high-density record -- the magnetic-recording medium which has the transfer characteristic can be offered

[0020] In the magnetic-recording medium of this invention, although mentioned later in detail, the poly

titanium (or poly zirconium) acetylacetonate added in a non-magnetic layer sticks to the front face of nonmagnetic powder. And this poly titanium (or poly zirconium) acetylacetonate is R1 and R2. By the portion of a hydrocarbon group, since compatibility with a binder, a solvent, etc. is good, where the above-mentioned nonmagnetic powder is adsorbed to a binder, it will fully function as a dispersant, and the dispersibility of nonmagnetic powder is raised.

[0021] therefore, detailed-izing -- while the property of nonmagnetic powder is fully demonstrated the bottom and the front face of a non-magnetic layer becomes smooth, smoothing of the front face of a magnetic layer is realized -- having -- the electromagnetism of the magnetic-recording medium of this invention -- it is thought that the transfer characteristic improves

[0022] Moreover, the lower layer which this invention becomes from the non-magnetic layer by which nonmagnetic powder was distributed in the binder, The upper layer which magnetic powder becomes from the magnetic layer distributed in the binder is prepared on a nonmagnetic base material. It faces manufacturing the magnetic-recording medium which the dispersant which consists of poly titanium (or poly zirconium) acetylacetonate contains in the aforementioned lower layer. The manufacture method of the magnetic-recording medium which carries out the multistory application of the magnetic paint for forming the nonmagnetic paint and the aforementioned upper layer for forming the aforementioned lower layer on the aforementioned nonmagnetic base material (the manufacture method of this invention is called hereafter.) It starts.

[0023] Since the multistory application (application of the sentiment-on wet method which applies a magnetic paint while the nonmagnetic paint applied especially has been non-dryness) of the magnetic paint for forming the nonmagnetic paint and the aforementioned upper layer for facing manufacturing the magnetic-recording medium of this invention, and forming the aforementioned lower layer is carried out on the aforementioned nonmagnetic base material according to the manufacture method of this invention, the aforementioned upper layer can be formed good [front-face nature]. Especially, in the case of a sentiment-on wet application method, while the lower layer aforementioned front face (namely, interface with the aforementioned upper layer) tends to become smooth, the front-face nature of the aforementioned upper layer becomes much more good, and the adhesive property between vertical both layers also improves.

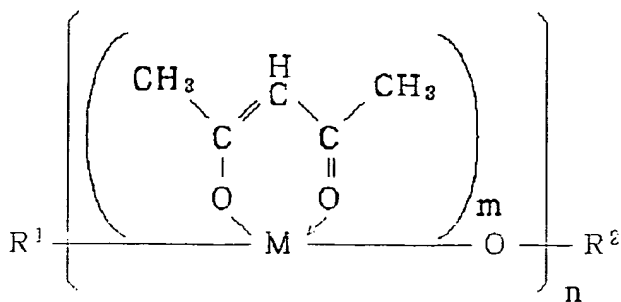
[0024] It becomes what fills the performance of a magnetic-recording medium demanded [noise / low / high power,] for this result, especially high-density record, film (layer) exfoliation decreases, and film (layer) intensity improves. Moreover, it becomes possible to reduce a dropout etc. and the reliability of a magnetic-recording medium also improves.

[0025]

[Embodiments of the Invention] As for the poly titanium (or poly zirconium) acetylacetonate used as a dispersant of nonmagnetic powder, in the magnetic-recording medium and its manufacture method (the magnetic-recording medium and its manufacture method of this invention may only be hereafter called the "this invention") of this invention, being expressed with the following general formula (I) is desirable.

[Formula 3]

一般式 (I) :



(However, a titanium atom or a zirconium atom, R1, and R2 M among the above-mentioned general

formula) Are the same. or it differs, respectively, a hydrogen atom, a hydrocarbon group (alkyl group of the carbon atomic numbers 1-10 etc.), An alkoxy group, halogen atoms (F, Cl, Br, etc.), a hydroxyl group, a nitro group, A carboxyl group, a carbonyl group, the amino group, an amide group, a sulfonic group, And the hydrocarbon group replaced by these (alkyl group of the carbon atomic numbers 1-10 etc.), it is aryl groups (a phenyl group, naphthyl group, etc.) and the basis chosen from the group which consists of complex aromatic machines (a basis: furan, a pyridine, etc. which have a heterocyclic compound), and n is polymerization degree, and 1 or the arbitrary integers beyond it (preferably 2 or more than it), and m show the number of ligands, and are $m \leq 2$

[0026] Here, as shown in the aforementioned general formula (I), poly titanium (or poly zirconium) acetylacetonate forms the chelate, when the oxygen atom in the carbonyl group and the metal atom M coordinate. Moreover, when the metal atom M is a titanium atom, a several m ligand is set to 2 at the maximum, and when the metal atom M is a zirconium atom, it is thought that a several m ligand takes 2 at the maximum.

[0027] In the poly titanium (or poly zirconium) acetylacetonate expressed with the aforementioned general formula (I), polymerization degree n can take one or more arbitrary integers. If the value of this polymerization degree n becomes large, the number of the poly titanium (or poly zirconium) acetylacetonate molecules contained in a constant rate will decrease, and the number of the poly titanium (or poly zirconium) acetylacetonate molecules which can stick to nonmagnetic powder decreases. However, although the value of this polymerization degree n is large, an adsorption power with nonmagnetic powder increases and the direction shows the bridge formation effect simultaneously. Therefore, in order to demonstrate the outstanding dispersibility, an optimum value exists, as for polymerization degree n, it is desirable that it is within the limits of 5-30, and it is still more desirable that it is within the limits of 10-20. However, it is contained in the dispersant of this invention when polymerization degree n is 1.

[0028] Moreover, as for the content of the poly titanium (or poly zirconium) acetylacetonate contained in a non-magnetic layer, it is desirable that it is 0.5 - 10 weight section to the nonmagnetic powder 100 weight section. When there are more these contents than 10 weight sections, a binder and an unreacted functional group remain mostly in a non-magnetic layer, and in order that these may do an interaction mutually (for example, it reacts with the polar group of a binder and viscosity rises), dispersibility tends to fall. On the other hand, when there are few contents of poly titanium (or poly zirconium) acetylacetonate than the 0.5 weight section, the function as a dispersant of fine particles is hard to be demonstrated. Moreover, in order to fully demonstrate the function as a dispersant, the 1.0 - 5.0 weight section is still more desirable in the addition.

[0029] Moreover, in case poly titanium (or poly zirconium) acetylacetonate is added to a non-magnetic layer, as long as it is within the limits which this addition mentioned above, two or more kinds of poly titanium (or poly zirconium) acetylacetonate may be added simultaneously, and you may use together with other dispersants.

[0030] Furthermore, in this invention, it is desirable to make specific surface area of nonmagnetic powder into within the limits of 30-80m² / g, and further 40-70m² / g.

[0031] Although mentioned later in detail, the front face of a non-magnetic layer tends to become still smoother by what specific surface area of nonmagnetic powder is made into within the limits of the above for (that is, nonmagnetic powder is atomized), and nonmagnetic powder becomes in a non-magnetic layer that it is easy to distribute in a binder and a solvent uniformly by distributed operation of the above-mentioned poly titanium (or poly zirconium) acetylacetonate.

[0032] the specific surface area of nonmagnetic powder -- 30m² / g -- being small (that is, the size of nonmagnetic powder being too large) -- the influence by the configuration of nonmagnetic powder may appear on the surface of a non-magnetic layer, and trouble may be caused to smoothing on the front face of a magnetic layer moreover, the specific surface area of nonmagnetic powder -- 80m² / g -- being large (that is, the size of nonmagnetic powder being too small) -- whether it uses the technique of this invention or adds poly titanium (or poly zirconium) acetylacetonate, there is an inclination it to become difficult to distribute very detailed nonmagnetic powder in a binder etc. The specific surface area of the

above-mentioned nonmagnetic powder is within the limits of 40-70m² / g more preferably.

[0033] moreover, improvement in an output [in / short wavelength / it is fully possible to set to 0.5 micrometers or less the upper average thickness (in fact average thickness after calender processing : average thickness per unit area) it is thin from a magnetic layer in this invention, if it is made 0.5 micrometers or less, are possible in reduction of a self-demagnetization loss (record demagnetization), and], improvement in an over-writing property, etc. -- like -- electromagnetism -- the transfer characteristic improves

[0034] If the upper average thickness it is thin from a magnetic layer exceeds 0.5 micrometers especially in the case of a multistory application type magnetic-recording medium like this invention that the upper average thickness it is thin from a magnetic layer is about 0.5 micrometers or less, although influence to the upper layer (magnetic layer) of a lower layer (non-magnetic layer : ground layer) cannot appear easily notably By making the aforementioned lower layer smooth in a distributed operation of the above-mentioned poly titanium (or poly zirconium) acetylacetonate, even if a magnetic layer is thin, the effect of this invention shows up in many cases notably -- the front face can be smoothed.

[0035] Moreover, in the manufacture method of this invention, it is desirable to apply a nonmagnetic paint on a nonmagnetic base material, and to apply a magnetic paint in the state of un-drying this paint. Although mentioned later in detail, while a lower layer front face becomes smooth by applying a magnetic layer in the state of un-drying a non-magnetic layer (namely, humid state), the upper front-face nature becomes good, and the adhesive property between vertical both layers also improves.

[0036] Moreover, although mentioned later in detail, a non-magnetic layer can apply a magnetic layer in the state of un-drying (namely, humid state) as mentioned above by carrying out the simultaneous multistory application of a lower layer (non-magnetic layer) and the upper layer (magnetic layer) on a nonmagnetic base material using a die coating machine.

[0037] Moreover, in the manufacture method of this invention, the nonmagnetic paint used as a lower layer raw material which consists of a non-magnetic layer can be prepared by the method of kneading and distributing the method of kneading and distributing poly titanium (or poly zirconium) acetylacetonate, nonmagnetic powder, and a binder with a solvent, and producing a nonmagnetic paint, or the nonmagnetic powder beforehand processed by poly titanium (or poly zirconium) acetylacetonate with a binder and a solvent, and producing a nonmagnetic paint etc.

[0038] Here, the mechanism at the time of the poly titanium (or poly zirconium) acetylacetonate of this invention functioning as a dispersant is explained, referring to drawing 5 .

[0039] Drawing 5 (A) shows the structure of an example of usable poly titanium (or poly zirconium) acetylacetonate to this invention expressed with a general formula (II), and is R1 and R2. The above-mentioned functional group or the above-mentioned atom etc. can be used. Moreover, in the aforementioned general formula (I), the metal atom M is a titanium atom and here shows the case where a several m ligand is 2.

[0040] In this invention namely, poly titanium (or poly zirconium) acetylacetonate In the metal atom M in the metallic oxide (-M-O-) which the metal atom M and the oxygen atom O have combined When the acetylacetone (2 and 4-2,4-pentanedione:CH₃ COCH₂ COCH₃) which is 2 seat ligand coordinates, a chelate is made, this makes straight chain-like structure or it is thought that polymer is formed in the shape of a straight chain.

[0041] As shown in drawing 5 (B), into nonmagnetic powder (for example, nonmagnetic powder of Fe system expressed with Fe-OH), when making the poly titanium (or poly zirconium) acetylacetonate shown in drawing 5 (A) contain, as it is shown in a general formula (III) and a general formula (IV), hydrogen bond is formed between the oxygen atom of the carbonyl group portion, and the hydrophilic front face of the aforementioned nonmagnetic powder, and it is thought that it combines with this nonmagnetic powder (adsorption). Moreover, as shown in drawing 5 (B), when an electron shifts, a general formula (III) and a general formula (IV) are considered to have a balanced relation.

[0042] Or as shown in a structure expression (I), a part of diketone is desorbed from the compound of a general formula (III) or a general formula (IV), this configures in Fe of nonmagnetic powder, and it is considered that a chelate is formed, or the diketone from which it was desorbed in part sticks to a

nonmagnetic powder front face as shown in a structure expression (II) (hydrogen bond or dehydration). Furthermore, as shown in a structure expression (III), it is also considered that Fe-O- has combined with the site from which the diketone (acetylacetone) was desorbed.

[0043] Moreover, poly titanium (or poly zirconium) acetylacetonate has compatibility with a binder (organic high molecular compound), a solvent (organic solvent), etc. from the structure, and as a result, so to speak, this poly titanium (or poly zirconium) acetylacetonate combines between a binder and nonmagnetic powder, and is considered to act effectively as a dispersant.

[0044] In this invention, you may prepare a back-coat layer in the field (rear face) in which the above-mentioned magnetic layer on a nonmagnetic base material is not prepared for the purpose of improvement in the performance traverse of a magnetic-recording medium, antistatic, imprint prevention, etc. Moreover, it is the purpose which strengthens the adhesive property of a paint film and a base material between a lower layer and a nonmagnetic base material, and it is also possible to prepare an under coat. This under coat cannot be overemphasized by that the above-mentioned lower layer (non-magnetic layer) in this invention is a different thing.

[0045] In this invention, the binder which the above-mentioned upper layer and an above-mentioned lower layer are made to contain has the well-known thermoplastics used as a binder for magnetic-recording media from the former, thermosetting resin, an usable reaction type resin, etc., and its number average molecular weight is [the thing of 5,000-100,000] desirable.

[0046] As an example of thermoplastics, a polyvinyl chloride, polyvinyl acetate, a vinyl chloride vinyl acetate copolymer, A vinyl chloride vinylidene chloride copolymer, a vinyl chloride-acrylonitrile copolymer, An acrylic-ester-acrylonitrile copolymer, an acrylic-ester-vinyl chloride vinylidene chloride copolymer, An acrylic-ester-acrylonitrile copolymer, an acrylic-ester-vinylidene-chloride copolymer, A methacrylic-ester-vinylidene-chloride copolymer, a methacrylic-ester-vinyl chloride copolymer, A methacrylic-ester-ethylene copolymer, the poly fluoride vinyl, a vinylidene-chloride-acrylonitrile copolymer, An acrylonitrile-butadiene copolymer, polyamide resin, a polyvinyl butyral, a cellulosic (a cellulose acetate butylate and cellulose die acetate --) A cellulose triacetate, cellulose propionate, a nitrocellulose, a styrene butadiene copolymer, a polyurethane resin, polyester resin, amino resin, synthetic rubber, etc. are mentioned.

[0047] Moreover, as an example of thermosetting resin or a reaction type resin, phenol resin, an epoxy resin, a polyurethane hardening type resin, a urea-resin, melamine resin, an alkyd resin, silicone resin, a polyamine resin, a formaldehyde resin, etc. are mentioned.

[0048] moreover, the purpose which raises the dispersibility of a pigment to all the above-mentioned binders -SO₃ M, -OSO₃ M, -COOM, and -P=O (OM) -- two etc. -- the polar functional group expressed may be introduced (here, M is alkali-metal atoms, such as a hydrogen atom or a lithium atom, a potassium atom, and a sodium atom)

[0049] Furthermore, as the above-mentioned polar functional group, there is a principal chain type thing expressed with -NR one R₂ and -NR₁ R₂ R₃+X-. The side-chain type thing which has the end group expressed, >NR₁ R₂+X - (it is here) R₁, R₂, and R₃ It is a hydrogen atom or a hydrocarbon group, and is X. - They are halogen ion, such as a fluorine, chlorine, a bromine, and iodine, inorganic, or organic ion. Moreover, you may introduce polar functional groups, such as -OH, -SH, -CN, and an epoxy group.

[0050] The amount of these polar functional groups has 10⁻¹ - desirable 10⁻⁸ mol/g, and they are 10⁻² - 10⁻⁶ mol/g more preferably.

[0051] Although the above-mentioned binder can use one sort independently, it is also possible to use two or more sorts together.

[0052] The amount of these binders in a paint film has the desirable 1 - 200 weight section to the above-mentioned ferromagnetic powder or nonmagnetic powder 100 weight section, and is 10 - 50 weight section more preferably.

[0053] When there is too much amount of this binder used, in the upper layer, the rate for which it accounts to the magnetic layer of ferromagnetic powder relatively falls, and an output tends to decline, and it is easy to start a plastic flow by repeat sliding by drive etc., and there is an inclination for the run

endurance of a medium to fall. On the other hand, if there is too little amount of the binder used, in a vertical layer, a paint film will become weak, and it will become easy for the run endurance of a medium to fall.

[0054] It is possible to use together the poly isocyanate which carries out bridge formation hardening of the above-mentioned binder in this invention. As this poly isocyanate, toluene diisocyanate or its adduct, alkylene diisocyanate, or its adduct exists.

[0055] The loadings to the above-mentioned binder of these poly isocyanates have desirable 5 - 80 weight section to the above-mentioned binder 100 weight section, and are 10 - 50 weight section more preferably.

[0056] Although these poly isocyanates can be used for vertical both layers, limiting and using only for any one layer is also possible. The loadings in the case of using for vertical both layers are possible also for carrying out an equivalent injection at each class, and can also be changed by arbitrary ratios.

[0057] In this invention, as ferromagnetic powder used in the upper layer Metals, such as Fe, Co, and nickel, Fe-Co, Fe-nickel, Fe-aluminum, Fe-nickel-aluminum, Fe-aluminum-P, Fe-nickel-Si-aluminum, Fe-nickel-Si-aluminum-Mn, Alloys, such as Fe-Mn-Zn, Fe-nickel-Zn, Co-nickel, Co-P, Fe-Co-nickel, Fe-Co-nickel-Cr, Fe-Co-nickel-P, Fe-Co-B, Fe-Co-Cr-B, Mn-Bi, Mn-aluminum, and Fe-Co-V, nitriding iron, a cementite, etc. are mentioned. Of course, it is a book though light metal elements, such as aluminum, Si, P, B, etc. which are added for the purpose, such as sintering prevention at the time of reduction or configuration maintenance, carry out suitable amount content.

[0058] Moreover, gamma-Fe 2O₃, Fe 3O₄, and gamma-Fe 2O₃ Fe 3O₄ Berthollide compound, Co content gamma-Fe 2O₃, the Co content Fe 3O₄, and gamma-Fe 2O₃ containing Co Fe 3O₄ A berthollide compound and CrO₂ There is an oxide which made one sort or the metallic element beyond it, for example, Te, Sb, Fe, B, etc., contain.

[0059] Furthermore, a hexagonal system tabular ferrite is also usable, it is the purpose which controls coercive force to M type, W type, Y type, a Z type barium ferrite, a strontium ferrite, a calcium ferrite, a lead ferrite, and these, and what added Co-Ti, Co-Ti-Zn, Co-Ti-Nb, Co-Ti-Zn-Nb, Cu-Zr, nickel-Ti, etc. is usable.

[0060] These ferromagnetic powder can also use [also using one sort, respectively or] two or more sorts together, although it is possible.

[0061] Moreover, the specific surface area of the ferromagnetic powder used for this invention has desirable 30-80m² / g, and they are 40-70m² / g more preferably. If this specific surface area is in the above-mentioned range, it is possible to obtain the magnetic-recording medium which the high-density record of was attained and was excellent in noise figure with atomization of the configuration of ferromagnetic powder.

[0062] Furthermore, as for the ferromagnetic powder used for this invention, it is desirable that major-axis length is [0.05-0.50 micrometers and an axial ratio] 2-15. When the distribution in a magnetic paint becomes difficult for major-axis length to be less than 0.05 micrometers and major-axis length exceeds 0.50 micrometers, there is a possibility that noise figure may deteriorate. And when the stacking tendency of ferromagnetic powder falls that an axial ratio is less than two, and it becomes the fall of an output and an axial ratio exceeds 15, there is a possibility that a short wavelength signal output may decline. In the case of a tabular ferrite, 0.01-0.5 micrometers of **** and about 0.001-0.2 micrometers of board thickness are desirable. However, the average of 100 or more sample particles chosen from the transmission-electron-microscope photograph at random shows major-axis length, an axial ratio, ****, and board thickness.

[0063] What is used in this invention as nonmagnetic powder which a lower layer is made to contain for example, alpha-Fe 2O₃ etc. -- a nonmagnetic iron oxide, a goethite, and a rutile type titanium dioxide -- Anatase type titanium oxide, the tin oxide, a tungstic oxide, oxidization silicon, A zinc oxide, a chrome oxide, a cerium oxide, titanium carbide, boron nitride, An alpha alumina, a beta alumina, gamma-alumina, a calcium sulfate, a barium sulfate, There are molybdenum disulfide, a magnesium carbonate, a calcium carbonate, a barium carbonate, a strontium carbonate, a barium titanate, etc., and these powder is possible also for using independently, and can also mix and use plurality.

[0064] The above-mentioned nonmagnetic powder is possible also for doping a suitable quantity of an impurity according to the purpose, and it is the purposes, such as improvement of dispersibility, conductive grant, and an improvement of a color tone, and it can also carry out surface treatment with compounds, such as aluminum, Si, Ti, Sn, Sb, and Zr.

[0065] The specific surface area of nonmagnetic powder has desirable 30-80m² / g, and they are 40-70m² / g more preferably.

[0066] Moreover, carbon black, such as a furnace for rubber, pyrolysis carbon, black for colors, and acetylene black, may be contained if needed.

[0067] It is desirable that the specific surface area of this carbon black is 100-400m² / g, and dibutylphthalate (DBP) oil absorption is 20-200ml / 100g.

[0068] If the specific surface area of nonmagnetic powder and carbon black is in the above-mentioned range, since a lower layer will smooth and the upper smoothing will become possible as a result by atomization of a configuration, it is possible for modulation noise figure to be excellent and to obtain a magnetic-recording medium with little influence of a spacing loss. Since nonmagnetic powder does not have magnetic cohesive force, there is a bird clapper that distribution of fine particles is difficult, and if specific surface area is too small, the surface smooth nature which can be equal to high-density record may be securable, even if it can crawl if distribution is easy compared with ferromagnetic powder, and it uses the technique of this invention, when specific surface area is larger than the above-mentioned range.

[0069] In this invention, it is possible to make the aforementioned magnetic layer and the aforementioned non-magnetic layer contain lubricant if needed. As the above-mentioned lubricant, these oligomer etc. is in the fatty acid ester which consists of a fatty acid to a graphite, molybdenum disulfide, a tungsten disulfide, a silicone oil, and the carbon atomic numbers 10-22, and this fatty acid and the alcohol to the carbon atomic numbers 2-26, a terpene system compound, and a row. The above-mentioned lubricant is possible also for adding only in the upper layer, and can also be added in vertical both layers.

[0070] Moreover, in this invention, it is possible to make the aforementioned magnetic layer contain an abrasive material particle. As these examples, there are an alpha alumina, a beta alumina, gamma-alumina, a chrome oxide, a silicon carbide, a diamond, a garnet, emery, boron nitride, titanium carbide, a silicon carbide, a titanium carbide, titanium oxide (a rutile, anatase), etc.

[0071] Below 20 weight sections of these particles are desirable to the ferromagnetic powder 100 weight section, and below its 10 weight sections are still better. Moreover, as for specific gravity, 2-6 are desirable, the range of 3-5 is still better, as for Mohs hardness, four or more are desirable, five or more are still better, and 0.3 micrometers or less are [0.5 micrometers or less of a mean particle diameter are desirable, and] still better [a mean particle diameter].

[0072] However, like the case of ferromagnetic powder, the mean particle diameter of these nonmagnetic abrasives particles is also measured from a transmission-electron-microscope photograph, and let it be the average calculated by statistics processing.

[0073] In this invention, although a well-known material can be used as a nonmagnetic base material, it is the base material formed by polymeric materials which are represented by celluloses, such as polyolefines, such as polyester, such as a polyethylene terephthalate, polyethylene -2, and 6-naphthalate, and polypropylene, a cellulose triacetate, and a cellulose diacetate, a vinyl system resin, polyimides, and polycarbonates or the metal, glass, ceramics, etc., for example.

[0074] Although it applies and dries by using formation material of the aforementioned vertical layer as a paint, respectively and is formed in order to form a paint film on the above-mentioned nonmagnetic base material The solvent used for this paint-ization An acetone, a methyl ethyl ketone, a methyl isobutyl ketone, Alcoholic system solvents, such as ketone system solvents, such as a cyclohexanone, a methanol, ethanol, and propanol, Methyl acetate, ethyl acetate, butyl acetate, propyl acetate, an ethyl lactate, Ester system solvents, such as ethylene glycol acetate, a diethylene-glycol wood ether, Ether system solvents, such as a 2-ethoxyethanol, a tetrahydrofuran, and a dioxane, Each well-known solvent, such as halogenated-hydrocarbon system solvents, such as aromatic-hydrocarbon system solvents, such

as benzene, toluene, and a xylene, methylene chloride, ethylene chloride, a carbon tetrachloride, chloroform, and a chlorobenzene, is usable.

[0075] It is performed in creation of the above-mentioned paint by each process of a kneading process, a mixed process, and a distributed process. A roll mill, a ball mill, a sand mill, an agitator, a kneader, an extruder, a homogenizer, an ultrasonic disperser, etc. are used for distribution and kneading.

[0076] Furthermore, in the manufacture method of this invention, although it is good to carry out the multistory application of the paint formed in this way simultaneously on a nonmagnetic base material, a die coating machine is mainly used for this in respect of high speed and fixed quantity application nature. As for the lip composition of a die coating machine, 2 lip methods, 3 lip methods, 4 lip methods, etc. are used.

[0077] Moreover, although an above-mentioned die coat method is suitable for this multistory application, the method of carrying out a multistory application by the gravure methods, such as the direct gravure method, the reverse gravure method, and the offset gravure method, can also be used.

[0078] part for a part of vertical layer [in / drawing 3 (A) / drawing 3 (A) shows the outline cross section of an example (for example, 8mm videotape) of the magnetic-recording medium of this invention, and / in drawing 3 (C)] -- it is an expansion outline cross section

[0079] That is, since the method (the so-called sentiment below - on-wet method = humid multistory application method: the same) which applies upper 2a to which lower layer 4a which consists of a non-magnetic layer mentioned above on the nonmagnetic base material 1 is prepared, and lower layer 4a becomes non-dried inside from a magnetic layer on this lower layer 4a is applied in order to manufacture this magnetic-recording medium, the adhesive strength between vertical layers becomes enough.

[0080] In addition, although the transition layer 5 which a part of paint component in magnetic layer 2a diffused, mixed into lower layer 4a, and magnetic powder mixed may be formed like a dashed line according to this method, this transition layer is not the upper layer or a lower layer strictly, either.

[0081] Moreover, with upper 2a of the nonmagnetic base material 1, you may have the back-coat layer 3 like an imaginary line in the field (rear face) of an opposite side.

[0082] Drawing 3 (B) is based on the method (the so-called sentiment-on dry method) which performs monostromatic [every] application and dryness, when forming lower layer 4b and magnetic layer 2b. Also in this case, you may have the back-coat layer 3 in the field of an opposite side with the magnetic layer.

[0083] Drawing 4 shows three examples (A) of the multistory application using the knockout applying method (die coating) of an usable sentiment-on wet method, (B), and (C) to the manufacture method of this invention.

[0084] The example (4 lip methods) for which drawing 4 (A) used two coating machines, the example (3 lip methods) which drawing 4 (B) makes breathe out a paint from a separate slit using one coating machine, and drawing 4 (C) show the example (2 lip methods) which makes each paint breathe out in piles from a single slit using one coating machine.

[0085] In the coater of drawing 4, they are paint 4 for lower layers a', and the thing which breathes out paint 2a' for magnetic layers, and forms two-layer [of lower layer 4a and upper 2a] by the sentiment-on wet method by the die coating machines 10 and 11 of an extrusion method, or 10, facing manufacturing the magnetic-recording medium of drawing 3 (A), for example, and sending the supplied nonmagnetic base material 1 to the direction of Arrow D.

[0086] The liquid reservoir sections 6 and 7 are formed in a die coating machine, and each paint 2a' and 4a' are simultaneously put on it by the sentiment-on wet method.

[0087] Generally, when forming lower layer 4a and upper 2a on a nonmagnetic base material, there is a method (the so-called sentiment-on wet application method) which applies in piles upper 2b which consists of a magnetic layer on the method (the so-called sentiment-on dry application method) which performs one layers of applications and dryness at a time, and lower layer 4a in the damp or wet condition which is not dried.

[0088] Since the upper magnetic layer 2a is applied while lower layer 4a has been in a humidity (un-

drying) state, while a lower layer front face (namely, interface with the upper layer) becomes smooth, the upper front-face nature does not need to become good, and it is not necessary to take into consideration the lower layer solvent resistance to the upper paint and, and there is an advantage that the adhesive property between vertical layers also improves, in the multistory application by the above-mentioned sentiment-on wet method.

[0089] It becomes what filled the military requirement as a magnetic-recording medium by which high power and a low noise are demanded for this result, especially high-density record, and ablation of a film (layer) is lost, and film (layer) intensity improves. Moreover, it is possible to also reduce a dropout and reliability also improves.

[0090] Moreover, when based on a sentiment-on dry application method as shown in JP,6-236543,A for example, there is a case which chooses what has sufficient solvent resistance as lower layer 4a to the paint of upper 2a which consists of a magnetic layer where it needs. However, the transition layer which a part of paint component in a magnetic layer diffused, mixed into the lower layer like the multistory application by the above-mentioned sentiment-on wet application method, and magnetic powder mixed is not formed.

[0091] moreover, as mentioned above, except when a clear boundary existed substantially between the vertical layers formed by the above-mentioned sentiment-on wet multistory application method, it was shown in drawing 3 (A) and drawing 3 (C) -- as -- fixed thickness -- with, although the border area where the component of both layers comes to be intermingled may exist, it is good considering the upper layer or the lower layer layer except such a border area as the above-mentioned magnetic layer and the above-mentioned non-magnetic layer. In any case, it is contained in the range of this invention.

[0092] In addition, if after the above-mentioned multistory application is introduced into a dryer and there is with the need further, it will be led to calender equipment and will be rolled round on a winding roll. Furthermore, after applying a back-coat layer to the opposite side of a multistory application layer, a slit is carried out to 8mm width of face, a magnetic tape is created, this is held in a cassette, and a tape cassette is manufactured.

[0093]

[Example] Hereafter, although a concrete example explains this invention, this invention is not limited to the following examples.

[0094] By the following composition, the paint for the upper layer (magnetic layer) and lower layers (non-magnetic layer) was prepared. That is, after mixing ferromagnetic powder or nonmagnetic powder, a binder, an additive, a solvent, and poly titanium (or poly zirconium) acetylacetonate with the predetermined compounding ratio and kneading by the extruder according to a conventional method, it mixed and distributed by the sand mill for 6 hours. However, the composition and the addition of poly titanium (or poly zirconium) acetylacetonate which were used for the following each example and examples of comparison were shown in the following table 1, respectively.

[0095]

<Magnetic paint composition for the upper layers (magnetic layer)> Ferromagnetic metal powder of Fe system (Fe80-Co20) The 100 weight sections (coercive force = 160 kA/m and amount of saturation magnetization = 145 Am² / kg, and specific-surface-area = 51m² /g, major-axis length = 0.08 micrometers, needlelike ratio = 3)

Polyvinyl chloride resin (-SO₃ K content) 14 weight sections (MR-110 by Nippon Zeon Co., Ltd.)

Polyester polyurethane resin (-SO₃ Na content) 3 weight sections (UR8300 by Toyobo Co., Ltd.)

Alpha-aluminum 2O₃ 5 weight sections Stearin acid 1 weight section Heptyl stearate 1 weight section

Methyl ethyl ketone The 150 weight sections Cyclohexanone The 150 weight sections [0096]

<Nonmagnetic paint composition for lower layers (non-magnetic layer)> Needlelike alpha-Fe 2O₃ The 100 weight sections (specific-surface-area = 53m² /g, major-axis length = 0.15 micrometers, needlelike ratio = 5)

Polyvinyl chloride resin (-SO₃ K content) 13 weight sections (MR-110 by Nippon Zeon Co., Ltd.)

Polyester polyurethane resin (-SO₃ Na content) 4 weight sections (UR8300 by Toyobo Co., Ltd.)

Poly titanium (or poly zirconium) acetylacetonate (a kind and an addition are indicated to the following

table 1)

Stearin acid 1 weight section Heptyl stearate 1 weight section Methyl ethyl ketone The 105 weight sections Cyclohexanone The 105 weight sections [0097] After carrying out the simultaneous multistory application on the polyethylene-terephthalate (PET) film with a thickness [as a nonmagnetic base material] of 7 micrometers and carrying out orientation processing by the solenoid coil after an appropriate time using the die coating machine of the **** 4 lip method having shown respectively the poly isocyanate (coronate L by the Japanese polyurethane company) in the magnetic paint for the upper layers and the nonmagnetic paint for lower layers which were obtained by the above composition as a curing agent at 3 weight ***** and drawing 4 , dryness, calender processing, and hardening processing were performed. Here, the lower layer which the upper layer which consists of a magnetic layer turns into from 0.2 micrometers and a non-magnetic layer set thickness of each class to 2.0 micrometers.

[0098] Furthermore, it applied to the nonmagnetic base material side (rear face) of an opposite side, and to 8mm width of face, to the above-mentioned application side, the slit of the paint for back-coat layers of the following composition was carried out, and it was tape-ized with it after an appropriate time.

[0099]

<Paint composition of a back-coat layer> Carbon black The 100 weight sections (Asahi #50 by the Asahi carbon company)

Polyester polyurethane The 100 weight sections (NIPPORAN N-2304 by the Japanese polyurethane company)

Methyl ethyl ketone The 500 weight sections Toluene The 500 weight sections [0100] An addition (weight section) as shown in Table 1 of Example 1 - the example 24 following, and the poly titanium (or poly zirconium) acetylacetonate of structure were used as a dispersant, and the magnetic tape (Examples 1-24) was obtained by the paint composition which mentioned above. In addition, Example 21 is 8mm by Sony Corp. The Hi8 tape was used. The sample tape of this example 21 is a tape which prepared the magnetic layer without preparing a non-magnetic layer (therefore, in a magnetic layer, the dispersant which consists of poly titanium (or poly zirconium) acetylacetonate, of course is not contained).

[0101] Moreover, the silane coupling agent by which the titanate coupling agent currently conventionally used for the non-magnetic layer as a dispersant is used, and the sample tape of Example 24 is also conventionally used for the non-magnetic layer as a dispersant is used for the sample tape of Example 23.

[0102] Moreover, although the sample tape of Example 20 is the same in the sample tape and composition of Example 4, and thickness The paint for the non-magnetic layers (lower layer) of sample tapes other than example 20 As opposed to kneading, and distributing and producing poly titanium acetylacetonate, nonmagnetic powder, and a binder with a solvent In the nonmagnetic powder beforehand processed by poly titanium acetylacetonate, with a binder and a solvent, it kneads and distributes and the paint for the non-magnetic layers (lower layer) of the sample tape of Example 20 is produced.

[0103] That is, the paint for non-magnetic layers (lower layer) of the sample tape of Example 20 fully mixes nonmagnetic powder (α -Fe $2O_3$) and poly titanium acetylacetonate in a solution beforehand, and with solvents and other additives, such as binders, such as a polyvinyl chloride resin and a polyester polyurethane resin, and a methyl ethyl ketone, and a cyclohexanone, it kneads and distributes and it produces this mixed solution.

[0104] moreover, electromagnetism -- measurement of the transfer characteristic -- a fixed-head formula -- electromagnetism -- it carried out using the transfer characteristic measuring instrument (reconstruction videocassette recorder by Sony Corp.) This measuring instrument consists of a rotating drum and the magnetic head in contact with this, and a magnetic tape serves as composition twisted around the aforementioned drum. First, actual measurement records a 10MHz square wave signal with the optimal record current of each sample tape, and detects a 10MHz output level (10MHz reproduction output) by the spectrum analyzer. In addition, it considers as 3.33 m/s and the relative velocity between a tape and a head is 8mm [reference / of Example 26 / (0dB of reproduction outputs)] by Sony Corp. The Hi8 tape was used.

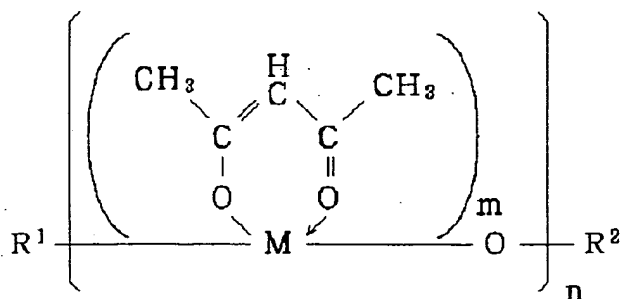
[0105] Furthermore, surface roughness Ra measured Ra (nm) about each sample tape using the non-contact type surface roughness meter (microscope for laser interference measurement made from ZYGO (Maxim 3D Model 5700)) by the laser beam interference method in the center line average coarseness on the front face of a magnetic layer.

[0106] These results are shown in the following table 2. The graph which shows change of the 10MHz reproduction output (dB) by the addition (weight section) of poly titanium acetylacetonate, and surface roughness Ra (nm) about each sample tape of Examples 1-8 and Example 22 moreover, to drawing 1. Furthermore, the graph which shows change of the 10MHz reproduction output (dB) by the polymerization degree n of poly titanium acetylacetonate and surface roughness Ra (nm) about each sample tape of Example 4 and Examples 9-13 was shown in drawing 2.

[0107]

Table 1 [Formula 4]

一般式 (I) :



Example Addition

The number of ligands	Polymerization degree M	R1	R2	(Weight section)	m	n	l	0.3	2						
15 Ti H ₃ CO- - CH ₃	2	0.5	2	15 Ti H ₃ CO- - CH ₃	3	1	2	15 Ti H ₃ CO- -CH ₃	4	3	2	15 Ti H ₃ CO- -CH ₃	5	5	
2	15 Ti H ₃ CO- - CH ₃	6	7	2	15Ti H ₃ CO--CH ₃	7	10	2	15 Ti H ₃ CO- - CH ₃	8	15	2	15 Ti H ₃ CO- -CH ₃	9	3
2	5 TiH ₃ CO--CH ₃	10	3	2	10 Ti H ₃ CO- - CH ₃	11	3	220 TiH ₃ CO--CH ₃	12	3	2	30 Ti H ₃ CO- - CH ₃	13	3	
250 Ti H ₃ CO--CH ₃	14	3	2	15 Zr H ₃ CO- - CH ₃	15	3	2	15 Zr (CH ₃) ₂ CHO-	-CH ₂	163	(CH ₃) ₂	15 Zr			
HO- - CH ₃	173	2	15 Ti HO- - CH ₃	18	32	15 Ti H ₃ CO- - C ₅ H ₇ O ₂	19	3	215 TiC ₅ H ₇ O ₂ -- C ₅ H ₇ O ₂	20	3				
2	15 Ti H ₃ CO- -CH ₃	21-	- - - - -	22	0 - - - - -	23	3 - - - -	24	3 - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	

[0108] Two tables 10MHz Reproduction output (dB) Surface roughness Ra1 (nm) + 2.9 5.12 + 4.1 4.53 + 5.6 3.34 + 6.0 3.05 + 6.0 3.16 + 5.5 3.57 + 5.3 3.78 + 3.1 4.99 + 5.63.310 + 5.73.211 + 5.83.212 + 5.53.513 + 3.14.914 + 5.93.115 + 5.9 3.016 + 5.5 3.417 + 5.6 3.318 + 6.0 3.119 + 6.1 3.020 + 6.2 2.921 0 8.322 + 2.75.323 + 3.1 4.924 + 3.14.9 ----- [0109] the sample tape by this example

8.322 +2.75.323 +3.1 4.924 +3.14.9 ----- [0109] the sample tape by this example (Example 1 - below example 20: the same) has the front face of a magnetic layer smoother than a result table 2 as compared with the reference tape of Example 21, or the sample tape of Example 22 which has not added the dispersant in the lower layer which consists of nonmagnetic powder (that is, surface roughness Ra is small) -- it is -- and electromagnetism -- what is excelled in the transfer characteristic (that is, a 10MHz reproduction output is large) is understood In addition, compared with the reference tape of Example 21, as for the tape of Example 22 of a multistory application, an output and front-face nature are carrying out improvement.

[0110] Although the sample tape of Example 23 and Example 24 is the example which used not a diketone compound but a titanate coupling agent or a silane coupling agent, powdered dispersibility does not improve, and an output level, front-face nature, etc. are not improved like the sample tape of this example. [twist / adsorption to nonmagnetic powder / poly titanium (or poly zirconium) acetylacetonate is progressing, and / and]

[0111] Moreover, although change of the 10MHz reproduction output (dB) by the addition (weight section) of the poly titanium acetylacetonate of each sample tape of Example 1 - Example 8, and Example 22 and surface roughness Ra (nm) was shown in drawing_1 , especially when the above-mentioned addition is within the limits of 0.5 - 10 weight section, the value which was very excellent is shown in a reproduction output and surface roughness. Moreover, it turns out that within the limits of

1.0 - 5 weight section is further excellent. Especially, 3 - 5 weight section is the most effective.

[0112] That is, when the above-mentioned addition becomes less than the 0.5 weight section, the effect of a dispersant is not fully demonstrated, but the front face of a magnetic layer is not smoother than the sample tape of above-mentioned within the limits, and there is an inclination for a reproduction output to become low. Moreover, when it increases more than 10 weight sections, the addition of a dispersant increases too much, a binder and an unreacted functional group remain mostly in a non-magnetic layer, and in order that these may do an interaction mutually, there is an inclination for dispersibility to fall.

[0113] Since it seems that there is almost no difference in the property of the sample tape of Example 4 and Example 20, and the direction of a performance of the sample tape of Example 20 is improving rather, moreover, the paint for non-magnetic layers (lower layer) It may be kneaded, and distributed and produced with a solvent, and poly titanium (or poly zirconium) acetylacetonate, nonmagnetic powder, and a binder It turns out that the nonmagnetic powder beforehand processed by poly titanium (or poly zirconium) acetylacetonate may be kneaded, and distributed and produced with a binder and a solvent, and that latter one may be excellent in a performance.

[0114] Moreover, in each sample tape by this example of Examples 1-20, although a high reproduction output value and good surface roughness Ra are obtained, as shown in Table 2 and drawing 2 (namely, Example 4 and Examples 9-13), in the aforementioned general formula (I), an optimum value exists in the value of the polymerization degree n of poly titanium (or poly zirconium) acetylacetonate, and the good result is obtained by each about by $n = 15$. Although the molecularity per unit weight increases [polymerization degree n / the smaller one] and polymerization degree n is large as this mentioned above, it is because the amount of adsorption to nonmagnetic powder increases and the direction is optimized on these both balance. Namely, although what is necessary is just one or more, as for the aforementioned polymerization degree n, it turns out that it is desirable that it is within the limits of 5-30, and within the limits of 10-20 is still more desirable.

[0115] Furthermore, like each sample tape of Example 4 and Examples 14-17, since there is almost no difference in the property, a titanium atom is sufficient as the metal atom expressed with "M" in the aforementioned general formula (I), and it turns out that a zirconium atom is sufficient. Moreover, when Example 4, and Example 14 and Example 16 are compared with Example 17, it turns out that the direction of Example 4 and Example 17 (what used the titanium atom as a metal atom M) is a little excellent in a performance.

[0116] moreover -- even if "R1" in the aforementioned general formula (I) and "R2" change, respectively like each sample tape of Example 4 and Examples 15-19 -- electromagnetism -- properties, such as the transfer characteristic and surface roughness Ra, are not influenced greatly, but all have a good result

[0117]

[Function and Effect of the Invention] while being able to distribute uniformly the nonmagnetic powder in a lower layer (namely, non-magnetic layer) in a binder and a solvent by poly titanium (or poly zirconium) acetylacetonate according to the magnetic-recording medium of this invention -- the upper (namely, magnetic layer) front face -- smooth -- carrying out -- the suitable high electromagnetism for high-density record -- the magnetic-recording medium which has the transfer characteristic can be obtained

[0118] Moreover, according to the manufacture method of this invention, while a lower layer front face (namely, interface with the upper layer) becomes smooth, the upper front-face nature becomes good, and the adhesive property between vertical both layers also improves. It becomes what fills the performance demanded as a magnetic-recording medium by which high power and a low noise are demanded for this result, especially high-density record, film (layer) exfoliation decreases, and film (layer) intensity improves. Moreover, it becomes possible to reduce a dropout etc. and the reliability of a magnetic-recording medium also improves.

[Translation done.]